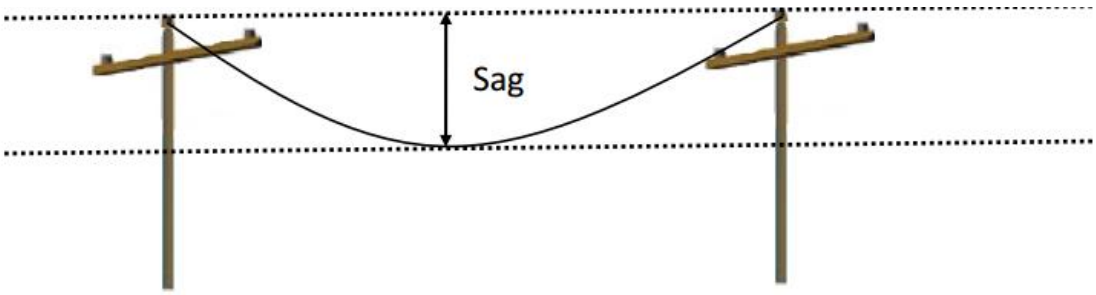
Chapter 5

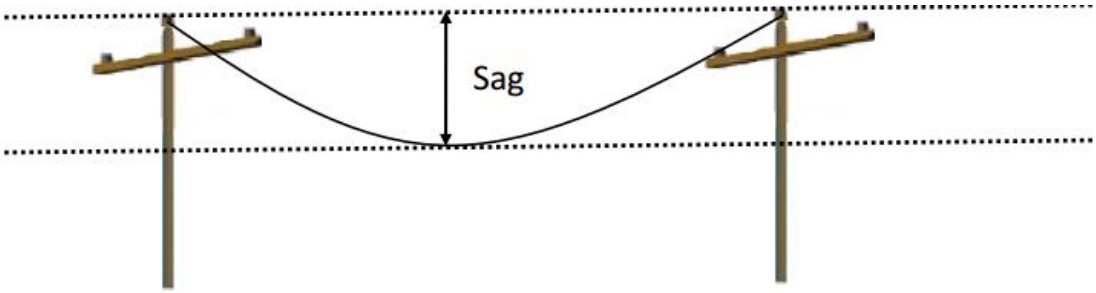
Sag: The difference in level between points of supports and the lowers point on the conductor is called sag.



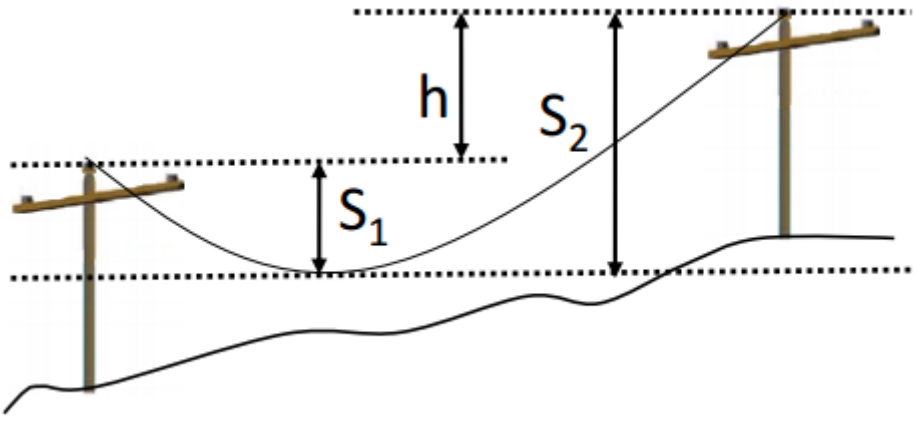
→ The tension is governed by conductor weight, effects of wind, ice loading and temperature variations.

→ In real life we may have two conditions of the transmission line:

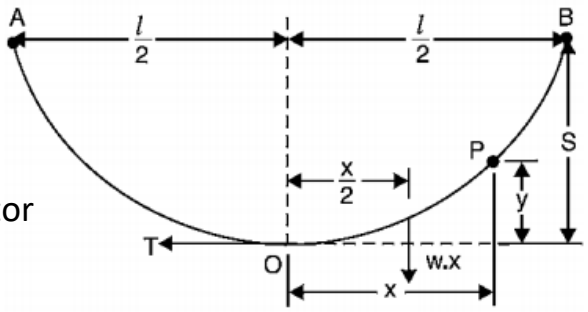
Supports at equal level:



Supports at unequal level:



Supports at equal levels:



l = Length of span

w = weight per unit length of the conductor

T = Tension in the conductor

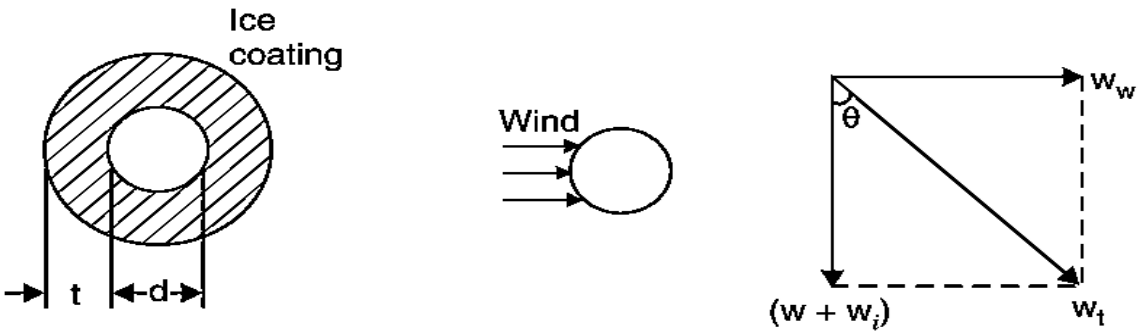
Equating the moments of forces about point 0, we get,

$Ty = wx \times \frac{x}{2}$ ➔ $y = \frac{wx^2}{2T}$

The maximum dip (sag) is represented by the value of y at either of the supports A and B.

At support A, x=l/2 and y=S ➔ (Sag) $S = \frac{W(\frac{l}{2})^2}{2T} = \frac{Wl^2}{8T}$

Ice and Wind loading:



w = weight of the conductor per unit length

w_i = weight of ice per unit length

w_w = wind force per unit length

Total weight of conductor per unit length is,

$\boldsymbol{Wt = \sqrt{(W + Wi)^2 + (Ww)^2}}$ $\boldsymbol{\theta = \tan^{-1}(\frac{Ww}{W+Wi})}$

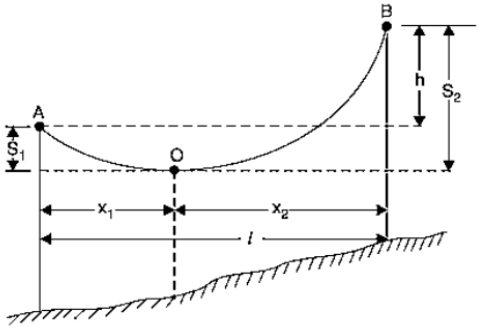
Vertical Sag = S cos θ

P7- A transmission line has span of 150 meters between the level supports. The conductor has a cross –sectional area of 2 cm2 .the tension in the conductor is 2000 kg. If the specific gravity of the conductor material is 9.9 gm/cm3 and wind pressure is 1.5 kg/m length, calculate the sag. What is the vertical sag?

P8- An overhead line has a span of 150m between level supports. the conductor has a cross-sectional area of 2 cm2 the ultimate strength is 5000kg/cm2 and safety factor is 5.the specific gravity of the material is 8.9 gm/cc. the wind pressure is 1.5 kg/m. calculate the height of the conductor above the ground level at which it should be supported if a minimum clearance of 7 m is to be left between the ground and the conductor.

Supports at unequal level:

Consider A and B are the two unequal supporters .the lowest point on the conductor is O.



L= span length

H= difference in levels between two supports

X1= distance of support at lower level (ie: A) from O.

X2 = distance of support at higher level (ie: B) from O.

T= tension in the conductor

If w is the weight per unit length of the conductor, then,

$$\text{Sag } S_1 = \frac{w x_1^2}{2T}$$

and $$\text{Sag } S_2 = \frac{w x_2^2}{2T}$$

Also $$x_1 + x_2 = l \qquad \ldots(i)$$

Now $$S_2 - S_1 = \frac{w}{2T}[x_2^2 - x_1^2] = \frac{w}{2T}(x_2 + x_1)(x_2 - x_1)$$

$\therefore$ $$S_2 - S_1 = \frac{w l}{2T}(x_2 - x_1) \qquad [\because x_1 + x_2 = l]$$

But $$S_2 - S_1 = h$$

$\therefore$ $$h = \frac{w l}{2T}(x_2 - x_1)$$

or $$x_2 - x_1 = \frac{2Th}{w l} \qquad \ldots(ii)$$

Solving exps. (i) and (ii), we get,

$$x_1 = \frac{l}{2} - \frac{T h}{w l}$$

$$x_2 = \frac{l}{2} + \frac{T h}{w l}$$

Having found x_1 and x_2, values of S_1 and S_2 can be easily calculated.

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